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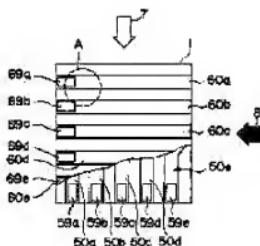
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## (54) FUEL CELL

## (57)Abstract:

PURPOSE: To even temperature and current density within the cell surface of each unit cell for forming a fuel cell.

CONSTITUTION: Grooves 50, 60 are provided in a separator 1 of a unit cell to form a fuel gas flow passage 5 and an oxidant gas flow passage 6. Flow quantity control valves 59, 69, of which open degree is changed in response to the temperature, are provided in each groove 50, 60. When the temperature abnormally rises, the flow quantity control valve 59 arranged in the fuel gas flow passage 5 is closed to reduce the flow quantity of the fuel gas flowing in the groove 50. When the temperature abnormally rises, the flow quantity control valve 69 arranged in the oxidant gas flow passage 6 is opened to increase the quantity of the oxidant gas. Temperature control is performed from both views of the cooling ability and the quantity of heat generation so as to eliminate the temperature distribution within the cell surface, and the cell performance is stabilized and the lifetime thereof is prolonged.



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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

[0001]

[Industrial Application]This invention relates to the fuel cell which was built over the fuel cell, especially attained equalization of the temperature distribution within a cell face.

[0002]

[Description of the Prior Art]A fuel cell carries out direct conversion of the chemical energy to electrical energy using electrochemical reaction.

It is observed as cleanliness and a high power generation method of an energy conversion efficiency, and research and development are energetically furthered towards utilization.

[0003]In order to use a fuel cell as a power generation system, it is necessary to make electrochemical reaction perform stably over a long period of time. And for that purpose, the temperature of a cell must be held uniformly. If battery temperature is too low, battery capacity will become low, and on the contrary, if temperature is too high, the life of a cell will become short. Therefore, temperature control is an element very important for a fuel cell. Temperature changes with kinds of electrolyte to be used, for example, in a phosphoric acid type, it is about 650 \*\* at about 200 \*\* and a melting carbonate type, and is about 1000 \*\* in a solid oxide type.

[0004]By the way, one by one [ cell ], since the generated voltage is small, in order to use it as a fuel cell, it is necessary to accumulate and constitute many cells (cell) generally. As for the above-mentioned temperature control, since the temperature of a cell differs for each cell of every, it is insufficient just to carry out collectively as the whole fuel cell. It is necessary to perform temperature control independently for every cell.

[0005]In order for various conditions (for example, a fuel gas flow, an oxidant gas flow, the state of an electrolyte plate, the state of the state cathode terminal of an anode electrode) to compound the temperature distribution of a cell and to act, the production of electricity and calorific value within an electrode surface change with the positions also about one cell. As a result, in the same cell face, the place where temperature is high, and a low place are made. Therefore, it is necessary to also equalize the temperature distribution in one cell.

[0006]Various art is proposed from the former that such temperature control should be realized. For example, in JP,63-16562,A, the cold plate provided with the gas mass flow control strip which operates according to cell temperature is installed every number cell. And it is trying to attain equalization of cell temperature distribution by controlling the gas mass flow inside a cold plate.

[0007]There is also an example which changed according to the temperature change and was provided with the member (for example, bimetal) which controls a gas mass flow like JP,63-41769,A and JP,613-58173,A and which provided the heat sink.

[0008]

[Problem(s) to be Solved by the Invention]However, the above-mentioned conventional technology attaches a cooling system for exclusive use, in order to cool a fuel cell hot section. Therefore, there was a fault that the whole device was enlarged and complicated. When priority was given to the miniaturizing point and simplification of a device, there was a problem that a radiation effect and a temperature distribution uniform effect will become small.

[0009]It is said that the temperature control in the above-mentioned conventional technology increases the quantity of the heat which this oxidizing gas takes by increasing fundamentally the flow of the cooling fluid (in this case, oxidizing gas) which flows through a high temperature portion. That is, it depended only on increasing refrigeration capacity (capability to take = heat) fundamentally. Therefore, there was also balance

with the conversion efficiency mentioned later, and there was a problem that sufficient temperature control could not be performed.

[0010]In the above-mentioned conventional technology, it was not fully able to opt for the temperature control within the same cell face, and it was not able to be performed finely. That is, the hot section is distributed in the same cell face at spot form in many cases. On the other hand, in 1 cell face, oxidizing gas flows in the fixed direction and goes. Therefore, when it was going to maintain this hot section to the optimal temperature, there was a problem that the temperature in the circumference (especially upstream section of this hot section) of this hot section will fall. And this had brought about the result of reducing the conversion efficiency to the electrical energy which is a selling point of the fuel cell maximum. On the contrary, when such a point was taken into consideration, the flow of oxidizing gas could seldom be increased but the limitation was among the ranges which can adjust temperature.

[0011]An object of this invention is to provide the fuel cell which attained current density within the cell face of each cell, and equalization of temperature distribution, without causing enlargement of the whole device, and complication.

[0012]An object of this invention is to provide the fuel cell which can perform temperature control, without depending only on adjustment of the flow of cooling fluid.

[0013]An object of this invention is to provide the fuel cell which made more exact temperature control possible, pressing down the influence which it has on portions other than an abnormal portion to the minimum.

[0014]

[Means for Solving the Problem]This invention was made to achieve the above objects, and as the 1st mode, An electrolyte attachment component which is arranged between an anode electrode, a cathode terminal, and the above-mentioned anode electrode and the above-mentioned cathode terminal, and holds an electrolyte, A fuel gas flow route arranged in contact with the above-mentioned anode electrode, and an oxidant gas passage arranged in contact with the above-mentioned cathode terminal, It is arranged in the above-mentioned fuel gas flow route, and a fuel cell constituting including a fuel control valve from which an opening changes according to temperature within the fuel gas flow route concerned is provided.

[0015]In this case, it is preferred to have further an oxidant gas flow control valve from which it is arranged in the above-mentioned oxidant gas passage, and an opening changes according to temperature in the oxidant gas passage concerned.

[0016]An electrolyte attachment component which is arranged between an anode electrode, a cathode terminal, and the above-mentioned anode electrode and the above-mentioned cathode terminal, and holds an electrolyte as the 2nd mode of this invention, A fuel gas flow route constituted including two or more fuel branch ways which touched the above-mentioned anode electrode and have been mutually arranged in parallel, A fuel cell having a fuel flow control means which can be adjusted for every fuel branch way for a flow of fuel gas which flows through an oxidant gas passage arranged in contact with the above-mentioned cathode terminal and the above-mentioned fuel branch way is provided.

[0017]As for the above-mentioned fuel flow control means, it is preferred that it is what adjusts a flow of fuel gas which passes through the fuel branch way concerned according to temperature of fuel gas which passes through each above-mentioned fuel branch way.

[0018]Flow control by the above-mentioned fuel flow control means decreases a flow of fuel gas which flows through the fuel branch way concerned, when temperature of the above-mentioned fuel gas is high, and when temperature of the above-mentioned fuel gas is low, it may be made in the direction which increases a flow of fuel gas which flows through the fuel branch way concerned.

[0019]As for the above-mentioned temperature, it is preferred that it is the temperature in an exit part of the above-mentioned fuel branch way.

[0020]The above-mentioned fuel flow control means may have the valve constituted including bimetal. Or the above-mentioned fuel flow control means may have the valve constituted including a shape memory alloy.

[0021]As for the above-mentioned valve, it is preferred to be arranged at an exit part of the above-mentioned fuel branch way.

[0022]As for the above-mentioned fuel flow control means, it is preferred to be constituted including a temperature detecting means which detects temperature of the above-mentioned fuel gas, and a valve from which an opening changes according to a detection result of the above-mentioned temperature detecting means.

[0023]It has a separator which adjoined the above-mentioned anode electrode and has been arranged, and has a slot which constitutes a part of above-mentioned fuel gas branch way in an opposed face with the above-

mentioned anode electrode of the above-mentioned separator, and the above-mentioned valve may be arranged at above-mentioned Mizouchi.

[0024]The above-mentioned oxidant gas passage is constituted including two or more oxidizer branch ways mutually arranged in parallel, and may have further an oxidizer flow rate control means which can be adjusted for every oxidizer branch way for a flow of oxidant gas which flows through the above-mentioned oxidizer branch way.

[0025]As for the above-mentioned oxidizer flow rate control means, it is preferred that it is what adjusts a flow of oxidant gas which passes through the oxidizer branch way concerned according to temperature of oxidant gas which passes through the above-mentioned oxidizer branch way.

[0026]If the above-mentioned oxidizer flow rate control means has a high temperature of the above-mentioned oxidant gas, a flow of oxidant gas which flows through the oxidizer branch way concerned will be decreased, and if temperature of the above-mentioned oxidant gas is low, a flow of oxidant gas which flows through the branch way concerned may be increased.

[0027]The above-mentioned anode electrode, an electrolyte attachment component, and a cathode terminal are laminated and arranged, are seen from the above-mentioned laminating direction, and, as for the above-mentioned fuel branch way and the above-mentioned oxidizer branch way, being provided in direction which crosses mutually is preferred.

[0028]The above-mentioned fuel gas flow route is further provided with a fuel bypass passage which connects the above-mentioned fuel branch way mutually, and, as for the above-mentioned fuel flow control means, it is preferred for a flow of fuel gas which flows through the above-mentioned fuel branch way to be independently adjusted by front [ of a crossing with the above-mentioned fuel bypass passage ] and the backside.

[0029]The above-mentioned oxidant gas passage is further provided with an oxidizer bypass passage which connects the above-mentioned oxidizer branch way mutually, and, as for the above-mentioned oxidizer flow rate control means, it is still more preferred for a flow of oxidant gas which flows through the above-mentioned oxidizer branch way to be independently adjusted by front [ of a crossing with the above-mentioned oxidizer bypass passage ] and the backside.

[0030]An electrolyte attachment component which is arranged between an anode electrode, a cathode terminal, and the above-mentioned anode electrode and the above-mentioned cathode terminal, and holds an electrolyte as the 3rd mode of this invention, A fuel gas flow route arranged in contact with the above-mentioned anode electrode, and two or more oxidizer branch ways which have been arranged in contact with the above-mentioned cathode terminal, and have been mutually arranged in parallel, An oxidant gas passage constituted including an oxidizer bypass passage which connects between these oxidizer branch ways, a flow of fuel gas which flows through the above-mentioned fuel branch way -- every oxidizer branch way -- and a fuel cell having an oxidizer flow rate control means which can be adjusted independently front [ of a crossing with the above-mentioned oxidizer bypass passage ] and the backside is provided.

[0031]According to temperature in a fuel gas flow route arranged in contact with the above-mentioned anode electrode as the 4th mode of this invention, an operating method of a fuel cell changing a fuel gas flow in the fuel gas flow route concerned is provided.

[0032]If the above-mentioned temperature of change of the above-mentioned flow is high, it will decrease the above-mentioned flow, and when the above-mentioned temperature is low, it may be performed in the direction which increases the above-mentioned flow.

[0033]

[Function]A fuel flow control means adjusts the flow of the fuel gas which passes through the fuel branch way concerned according to the temperature (temperature especially in an exit part) of the fuel gas which passes through each fuel branch way. This flow control decreases the flow of the fuel gas which flows through the fuel branch way concerned, when the temperature of the above-mentioned fuel gas is high, and when the temperature of the above-mentioned fuel gas is low, it is performed in the direction which increases the flow of the fuel gas which flows through the fuel branch way concerned. Thereby, the fuel gas supply to a hot section is controlled, and it controls, the reacting weight, i.e., the calorific value, in this hot section.

[0034]An oxidizer flow rate control means adjusts the flow of the oxidant gas which passes through the oxidizer branch way concerned according to the temperature (temperature especially in a \*\*\*\*\* part) of the oxidant gas which flows through an oxidizer branch way. If this flow control has a high temperature of oxidant gas, it will decrease the flow of the oxidant gas which flows through the oxidizer branch way concerned, and if the temperature of the above-mentioned oxidant gas is low, it will be performed in the direction which increases the flow of the oxidant gas which flows through the branch way concerned. Thereby, the amount of supply of

the oxidant gas to a hot section is increased, and the quantity (refrigeration capacity in a hot section) of the heat which oxidant gas takes in this hot section is increased.

[0035]In a low temperature part, increase of calorific value and control of refrigeration capacity are performed contrary to above-mentioned explanation.

[0036]If the fuel branch way and the oxidizer branch way are established in the direction which crosses mutually, in an abnormality part, the effect of the above-mentioned calorific value control and the effect of refrigeration capacity control will overlap, and it will act. Therefore, the greatest effect can be acquired, minimizing the influence which it has on other normal fields.

[0037]In the example provided with the oxidizer bypass passage and the fuel bypass passage, temperature etc. can be equalized more finely.

[0038]

[Example]The 1st example of this invention is described using a drawing.

[0039]The fuel cell of this example generates electricity by making the fuel gas and oxidant gas which are supplied with the pumps 91 and 92 react as it is shown in drawing 1. And the generated electrical and electric equipment is supplied to load.

[0040]A fuel cell laminates two or more cells, and is constituted. The composition of the cell used as the foundations of the fuel cell of this example is shown in drawing 2.

[0041]This cell is constituted including the electrolyte plate 3, the anode electrode 2 and the cathode terminal 4 which are arranged on both sides of the electrolyte plate 3 at the both sides, and the separator 1. The separator 1 is for dividing between cells, and does not constitute a cell strictly. However, since a slot is established in the surface of this separator and this is usually made into channels, such as fuel gas, suppose here that this separator is also treated as a component of a cell.

[0042]The separator 1 divides between each cell. Two or more slots 50 which constitute the fuel gas flow route 5 are established in the whole surface side of this separator 1 in parallel. Two or more slots 60 of the separator 1 which, on the other hand, constitute the oxidant gas passage 6 in a similar manner in a side are formed in the fuel gas flow route 5 and the direction which goes direct. It passes along the space where oxidant gas is formed between the slot 60 and the cathode terminal 4 on the other hand in the space where fuel gas is formed between the slot 50 and the anode electrode 2, and has the structure of flowing in the respectively fixed direction.

[0043]Although the separator 1 of this example is not drawn on drawing 2, it equips each of the slot 50 with the flow control valve 59. Each of the slot 60 is equipped with this flow control valve 69. These flow control valves 59 and 69 are shown in drawing 3.

[0044]The flow control valve 59 is for controlling current density and temperature by adjusting reacting weight (calorific value). The flow control valve 59 is arranged near the exit of each slot 50.

The exit part of the slot 50 concerned is opened and closed according to the temperature of the fuel gas which has flowed through the slot 50 concerned.

The flow control valve 59 operates in the direction which will be closed if the temperature of fuel gas becomes higher than a design operating temperature (in namely, direction which reduces the flow of fuel gas), and in the direction which will be opened if it becomes lower than a design operating temperature conversely, it is constituted so that it may operate (in namely, direction which increases the flow of fuel gas). Each flow control valve 59 can operate in mutually-independent.

[0045]In this example, the flow control valve 59 is constituted using bimetal. The low expansion side material is [ an iron nickel alloy and the high expansion side material of the construction material of the used bimetal ] iron, manganese chromium, and an alloy. This flow control valve 59 is made into the shape (in this example, it is a square shape) doubled with the shape of the slot 50 so that a flow could be adjusted efficiently. Spot welding is performing attachment to the separator 1. The shape of the flow control valve 59 is not limited to this, and can use suitably various shape, such as circular and semicircular shapes. Not only welding but a screw stop, integral-construction-izing with a channel, etc. can apply other various methods also to the mounting arrangement of the flow control valve 59.

[0046]The flow control valve 69 tends to control temperature by adjusting refrigeration capacity. The flow control valve 69 opens and closes the slot 60 concerned according to the temperature of oxidant gas. Although this flow control valve 69 is the same as the flow control valve 59 fundamentally, as for the flow control valve 59, the operating direction of the valve to a temperature change is made reverse. That is, the flow control valve 69 is constituted so that it may operate in the direction which will be opened if the temperature of oxidant gas becomes higher than a design operating temperature (in namely, direction which increases the flow of oxidant

gas) and may operate in the direction which will be closed if it becomes lower than a design operating temperature (in namely, direction which reduces the flow of oxidant gas).

[0047]As for the separator 1 and the anode electrode 2, the construction material of the cathode terminal 4 and the electrolyte plate 3, shape, etc. are determined according to the kind of fuel cell. For example, when using melting carbonate as an electrolyte, stainless steel can be used as the separator 1, and the porous body of a nickel alloy can be used as the anode electrode 2 and the cathode terminal 3. The porous body of alumina or magnesium can be used as the electrolyte plate 3.

[0048]The "fuel flow control means" said in a claim is equivalent to the flow control valve 59 in this example. An "oxidizer flow rate control means" is equivalent to the flow control valve 69. A "fuel branch way" is equivalent to the space formed in each slot 50 and the anode electrode 2. "The fuel branch way mutually arranged in parallel" means the physical relationship the slot 50a, b, c, d, and between e. It realizes with the "oxidizer branch way" as space formed with each slot 60 and the cathode terminal 3. "The oxidizer branch way mutually arranged in parallel" means the physical relationship the slot 60a, b, c, d, and between e.

[0049]The temperature control operation in the fuel cell of this example is explained using drawing 4.

[0050]drawing 4 showed signs that the cell of the fuel cell of this example was seen from the upper part – it is. Since the structure of the fuel gas flow route 5 is expressed, the part is used as the perspective diagram. It drew with the circle of the dashed line by making into the abnormality part A the high temperature portion (or low temperature part) generated in the cell face. It is assumed that the fuel gas 7 is flowing in the direction of a white arrow in the slot 50. It is assumed that the oxidant gas 8 is flowing in the direction of a black-colored arrow in the slot 60.

[0051]The fuel gas 7 is supplied to the anode electrode 2 through the slot 50. The oxidant gas 8 is similarly supplied to the cathode terminal 4 through the slot 60. And the electrical and electric equipment and heat are generated by electrochemical reaction all over the anode electrode 2 and the cathode terminal 4.

[0052]When the current density and temperature in the abnormality part A are high unusually, the slot 50a in the position corresponding to this abnormality part A and the fuel gas 7 which has passed b are an elevated temperature. Therefore, the flow control valves 59a and 59b operate in the closed direction, and the flow of the fuel gas 7 which flows through the slots 50a and 50b is decreased. As a result, the reacting weight (namely, calorific value) of the electrochemical reaction in the slot 50a and the field in alignment with b decreases, and current density and temperature fall.

[0053]The amount of supply of the fuel gas of whole fuel cell DE is controlled by the fuel cell by the pump 91 grade (refer to drawing 1). Therefore, the amount of supply of fuel gas does not decrease as it is only the part decreased in the quantity of the fuel gas 7 which flows through the slots 50a and 50b. The quantity of the fuel gas 7 with which only the quantity of these decrements which corresponds in part at least flows through the slots 50c, 50d, and 50e increases. By this, while maintaining the output value in the whole fuel cell, equalization of the current density distribution and temperature distribution in the whole cell face can be attained. In such a meaning, the flow control valve 59 will also exhibit the distribution frame of the fuel gas to each slot 50. About this point, the flow control valve 69 is also the same.

[0054]The slot 60a and the oxidant gas 8 which has passed b are an elevated temperature similarly. Therefore, the flow control valves 69a and 69b operate to an open direction, and increase the flow of the oxidant gas 8 which flows through the slots 60a and 60b. As a result, the refrigeration capacity in the field along the slots 60a and 60b can increase, and the temperature in this field can be lowered.

[0055]When the current density and temperature in the abnormality part A are falling unusually, it acts contrary to the above. That is, the flow control valves 59a and 59b operate to an open direction, and the flow of the fuel gas 7 which flows through the slots 50a and 50b increases. As a result, the reacting weight (namely, calorific value) of the electrochemical reaction in the slot 50a and the field in alignment with b increases, and the current density and temperature in this field increase. The flow control valves 69a and 69b operate in the closed direction, and the flow of the oxidant gas 8 which flows through the slots 60a and 60b decreases. As a result, the refrigeration capacity in the field along the slots 60a and 60b declines, and the temperature in this field increases.

[0056]Control (.) of the calorific value according [ the regulating function of the current density and temperature which are realized by such a mechanism ] to the flow control valve 59 Or increase and increase (or control) of the refrigeration capacity by the flow control valve 69 will be most effectively demonstrated in the portion (in this case, the abnormality part A) which overlaps and acts.

[0057]this example – each slot 50 – (– after summarizing two or more slots 50 (60) to one, it may be made to form the flow control valve 59 (69) like drawing 5, although the flow control valve 59 (69) is attached to every

60), respectively. Cost reduction can be planned if it does in this way. On the contrary, two or more flow control valves 59 (69) may be formed in the one slot 50 (60) like drawing 6. If it does in this way, the range which can adjust a flow will become large.

[0058]The 2nd example of this invention is described using drawing 7.

[0059]This example provided flow control valve 59' (69') also in the just before position of the intersection of the slot 50 (60) and the bypass slot 52 (62) while forming the bypass slot 52 (62) which connects between each slot 50 of separator 1' (60). the portion which is in the upstream from the bypass slot 52 (62) of the slot 50 (60) hereafter -- slot 50' (60') -- the portion in the downstream is called slot 50" (60").

[0060]The composition of flow control valve 59' and 69' itself is the same as that of the 1st example of the above. It is the same as that of the 1st example of the above about other portions. The figure with which drawing 7 (a) looked at separator 1' from the slot 50 side, and drawing 7 (b) are the figures which looked at separator 1' from the slot 60 side.

[0061]The bypass slot 52 (62) is formed so that between each slot 50 (60) may be connected. Thereby, not only the gas that has passed slot 50a' but a part of gas which has passed slot 50b, c, d, and e can flow into slot 50a", for example. The inflow not only to slot 50a" but slot 50b, c, d, and e of the gas which has passed slot 50a' is attained conversely.

[0062]Slot 50' and slot 50" constitute "fuel branch way" where each is another. On the other hand, "the fuel branch way mutually arranged in parallel" means the physical relationship slot 50a', b, c, d, the physical relationship between e and slot 50'a, b, c, d, and between e. Similarly, the oxidizer branch way arranged in parallel means the physical relationship slot 60'a, b, c, d, the physical relationship between e and slot 60'a, b, c, d, and between e.

[0063]Operation is explained.

[0064]An abnormality part -- B -- it can set -- current density -- and -- temperature -- unusual -- high -- becoming -- \*\*\* -- a case -- \*\*\* -- this -- an abnormality part -- B -- immediately after -- a position -- it is -- a flow control valve -- 59 -- a -- ' -- 59 -- b -- ' -- closed -- a direction -- operating . Then, the flow of the fuel gas 7 which flows in the slots 50a and 50b decreases. As a result, the reacting weight (namely, calorific value) of the electrochemical reaction in the field (getting it blocked the abnormality part B) met in the slots 50a and 50b decreases, and current density and temperature fall.

[0065]At least the part of the parts in which the quantity of the fuel gas 7 which flows in the slots 50a and 50b decreased flows in the slots 50c, 50d, and 50e. and -- a slot -- 50 -- a -- " -- 50 -- b -- " -- \*\*\* -- a slot -- 50 -- a -- ' -- 50 -- b -- ' -- passing -- having flowed -- gas -- not only -- a slot -- 50 -- c -- ' -- 50 -- d -- ' -- 50 -- e -- ' -- passing -- having flowed -- gas -- a pie -- a bus -- a slot -- 52 -- leading -- flowing in . Therefore, fuel gas is fully supplied to the field met in these slots 50a and 50b. That is, since fuel gas bypasses the abnormality part B and flows, it can make small the adverse effect which it has on portions (the example of drawing 7 especially downstream portion of the abnormality part B) other than the abnormality part B. Unlike the example of drawing 7, when the abnormality part B arises in the downstream (getting it blocked field of slot 50") more, similarly, fuel gas can bypass the abnormality part B and can flow.

[0066]On the other hand, it operates to an open direction in the flow control valves 69a and 69b in the position just behind this abnormality part B. Then, the flow of the oxidant gas 8 which flows in the slots 60a and 60b increases, and the refrigeration capacity in the field met in the slots 60a and 60b increases. As a result, the temperature of the abnormality part B falls.

[0067]The quantity of the oxidant gas 8 with which only the part in which the quantity of the oxidant gas 8 which flows in the slots 60a and 60b increased flows in the slots 60c, 60d, and 60e decreases. However, if it sees about each of the slots 60c, 60d, and 60e, since the decrement is small, there will be no adverse effect.

[0068]Passing in the slots 60a and 60b, the oxidant gas which has flowed flows in the slots 60c, 60d, and 60e not only through the slots 60a and 60b but through the pie bus slot 62. Therefore, a lot of oxidant gas does not flow into these slots 60a and 60b. That is, since oxidant gas spreads in the whole again after it gathers from the whole oxidizer passage and cools the abnormality part B intensively, it can make small influence which it has on portions (especially the downstream portion and upstream portion of the abnormality part B) other than the abnormality part B.

[0069]Finer control will be attained if many bypass slots 52 (62) are formed further.

[0070]In this 2nd example, while maintaining the output value in the whole fuel cell, much more equalization of the current density distribution and temperature distribution in the whole cell face can be attained.

[0071]Since each example described above acts from the field of the both sides of refrigeration capacity and calorific value, it can perform control of current density and temperature effectively. It is efficient in order to act

on an abnormally-high-temperature (low temperature) portion intensively. Since the fall of the production of electricity accompanying temperature control is suppliable in other normal portions, when it sees as the whole fuel cell, there is almost no fall of an output. As for increase of refrigeration capacity, in order to \*\*\* and to make small reduction of the generation efficiency of the fuel cell itself as much as possible, using as an auxiliary means is preferred.

[0072]The effect by adjustment of such refrigeration capacity is useful especially in the fuel cell of the type which uses oxidant gas for cooling essentially, i.e., a fused carbonate fuel cell etc.

[0073]When exact temperature control became possible, the partial corrosion within a cell face, modification, scattering by electrolytic evaporation, etc. can be prevented. Useless consumption of fuel gas can be prevented. By having equalized current density distribution, cell performance improves and generation efficiency rises. The power generation reaction fall due to the fall of temperature is also cancelable.

[0074]Since a complicated control mechanism etc. are not needed, it is advantageous also in respect of the reliability of a device, and a manufacturing cost.

[0075]The composition of this example may function also as a security apparatus exceeding a role of a control mechanism of a mere temperature and current density. That is, since the flow control valves 59 and 69 operate in mutually-independent altogether, in the case where a fuel cell begins a reckless run etc., a reckless run can be stopped because it will be in the state which all the flow control valves 59 closed, and the state where all the flow control valves 69 opened (or beforehand prevention). And the reliability is extremely excellent. Generally, the security apparatus is not operating at all, while apparatus (in this case, fuel cell) is operating normally. Therefore, when an accident occurs, it cannot usually be checked whether the security apparatus operates normally. However, in this example, since it is operating from usually as control mechanisms, such as temperature, it can always check operating normally.

[0076]In the above-mentioned example, the flow control valves 59 and 69 were realized using bimetal. However, a concrete realization method is not limited to this and may use a shape memory alloy, for example. As a shape memory alloy, there are a TiNiNb alloy, a FeNiC alloy, a FeMnSi alloy, etc. What kind of thing is used should just choose suitably in accordance with a service condition etc.

[0077]The parts of 1 do not necessarily need to combine the function which detects temperature, and the valve function which adjusts a flow according to the detected temperature. For example, you may realize by combining the temperature sensor of a thermo couple, and the valve in which opening adjustment is possible. As for the field which is the target of temperature detection, even when a temperature detecting function and the flow adjustability are divided and considered in this way, it is preferred that it is an exit part of a channel (slots 50 and 60). This is because the abnormalities caused in the downstream rather than the temperature detection object area concerned are undetectable if temperature detection is performed in the middle of a channel (slots 50 and 60). On the other hand, it is not necessary to necessarily arrange the valve for adjusting a flow to the exit part of a channel. Even if it arranges a valve in which positions in the middle of the entrance of a channel etc., it is because it is possible to adjust the flow of the channel (slots 50 and 60) concerned.

[0078] The above-mentioned example was provided with both the flow control valve 59 and the flow control valve 69. However, a certain amount of effect also as composition provided only with either is expectable.

[0079] Since the above-mentioned example aimed also at attaining equalization of the temperature within a cell face, and current density, it had provided two or more branch ways parallel-wise and in in-series. The channel of oxidant gas and the channel of fuel gas were established in direction which crosses mutually. However, if it aims only at maintaining temperature at the predetermined range, it is not necessary to divide a channel into plurality and to provide it. Also when this example is applied without dividing a channel into plurality, temperature control can be performed correctly. This is because detection of temperature, etc. are performed immediately near the exothermic part.

0080) Finally, the range which can apply the above-mentioned example is described.

[0081]The above-mentioned example explained only paying attention to the field of reacting weight control, without touching on fuel gas on the side as a cooling medium. However, fuel gas may also function also as a cooling medium actually. It is possible conversely to also use oxidant gas for reacting weight control.

Therefore, when applying this invention, it is necessary to take the following points into consideration:

Therefore, when applying this invention, it is necessary to take the following points into consideration. However, the above-mentioned example is applicable as it is under the operating condition of the fuel cell with which research and development are done actually.

[0082]Under an operating condition which is not a flow of oxidant gas and is determined with the flow of fuel gas (operating condition that it is gas blocked and oxidant gas exists superfluously to fuel gas), reacting weight can apply the above-mentioned example. In the operational status that fuel gas exists superfluously to oxidant

gas, even if it controls the flow of fuel gas, reacting weight cannot be adjusted. Under such an operating condition, when the flow of fuel gas is reduced, it is only causing reduction of the chilling effect by fuel gas. When the flow of oxidant gas is increased, reacting weight is made to increase on the contrary. Under such an operating condition, flow control of oxidant gas can perform control of reacting weight, and the flow of fuel gas can perform control of refrigeration capacity. Therefore, the operating direction of the flow control valves 59 and 69 is made contrary to the above-mentioned example in this case. That is, if temperature becomes high, the flow control valve 59 will open and, on the other hand, the flow control valve 69 will be closed.

[0083]If the constant level which has a fuel gas flow under the operating condition that oxidant gas exists superfluously to fuel gas is exceeded, even if it will increase a flow more, reacting weight hardly increases. In such a operating range, increase of a fuel gas flow acts so that the quantity (cooling action get it blocked and according to fuel gas) of the heat which fuel gas takes may be made to increase and temperature may be reduced to a fuel cell. Therefore, it is necessary to determine the adjustable range of a flow in consideration of such a point. As for the account of the upper, the existing constant level is determined by various conditions, such as a diffusion rate of reacting matter, thickness of a diffusion zone, and a state of an electrode surface.

[0084]

[Effect of the Invention]According to this invention, the current density distribution and temperature distribution within the cell face of a fuel cell can be equalized as explained above. The corrosion of the cell member by the abnormal heat generation within a cell face, modification by the thermal expansion of a cell member, scattering by electrolytic evaporation, etc. can be controlled. The capacity factor of fuel gas improves and generation efficiency rises.

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[Translation done.]

**\* NOTICES \***

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- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

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**DESCRIPTION OF DRAWINGS**

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[Brief Description of the Drawings]

[Drawing 1]It is a block diagram showing the outline of the fuel cell which is the 1st example of this invention.

[Drawing 2]It is a perspective view showing the basic constitution of the cell contained in a fuel cell.

[Drawing 3]It is a perspective view showing the fitting state of the flow control valve 59 and the flow control valve 69.

[Drawing 4]It is a figure showing the working principle of this example.

[Drawing 5]It is a figure showing the modification of this 1st example.

[Drawing 6]It is a figure showing the modification of this 1st example.

[Drawing 7]this invention -- the -- two -- an example -- it can set -- a separator -- one -- ' -- and -- a flow control valve -- 59 -- ' -- 59 -- " -- 69 -- ' -- 69 -- " -- being shown -- a figure -- it is .

[Description of Notations]

1[ .... Cathode terminal, ] .... A separator and 2 .... An anode electrode and 3 .... An electrolyte plate and 4 5 .... A fuel gas flow route and 6 .... An oxidant gas passage and 7 .... Fuel gas, 8 [ .... A bypass slot and 59 / .... A flow control valve, 60 / .... A slot and 62 / .... A bypass slot and 69 / .... A flow control valve and 91 / .... A pump, 92 / .... A pump and A / .... An abnormality part and B / .... Abnormality part] .... Oxidant gas and 10 .... A flow control valve and 50 .... A slot and 52

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[Translation done.]

## \* NOTICES \*

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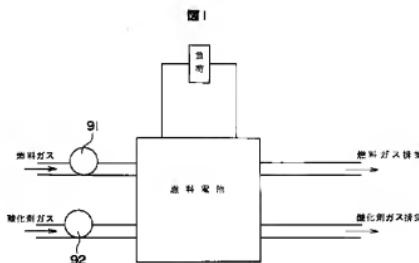
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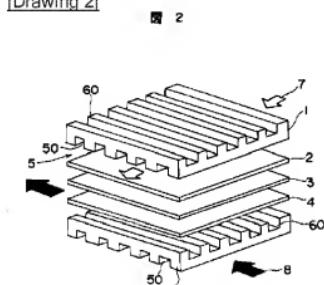
DRAWINGS

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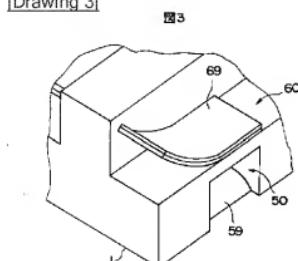
## [Drawing 1]



## [Drawing 2]

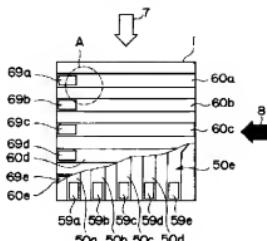


## [Drawing 3]



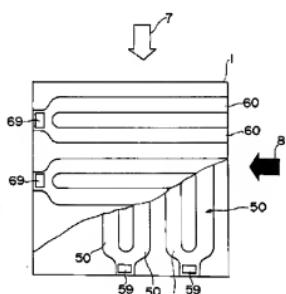
[Drawing 4]

図4



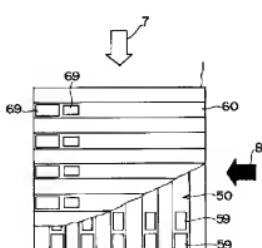
[Drawing 5]

図5

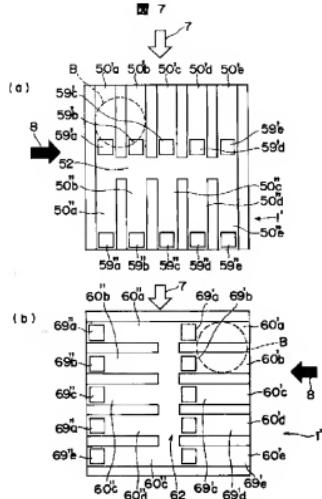


[Drawing 6]

図6



[Drawing 7]



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[Translation done.]